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FARMING SYSTEMS AND AGRICULTURAL PRODUCTION AMONG SMALL FARMERS IN THE ULUGURU MOUNTAIN AREA, MOROGORO REGION, TANZANIA

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ABSTRACT A farming systems approach is used to explain the problems of small scale farmers in the Uluguru Mountain Area in Morogoro region, Tanzania.

A survey, involving 60 small farmers selected at random, was conducted by means of questionnaires, discussions as well as field observations. It was revealed that although farmers in this area practice a variety of cropping systems partly taken over the know-how of the older shifting type of cultivation, and considered more appropriate to deal with the farming problems in this mountainous area, agricultural production is declining sharply because current cultural practices have failed to keep up with the changes occurring in the area.

Key Words: Farming systems; Subsistence production; Mixed cropping; Intercropping; Uluguru Mountain area.

INTRODUCTION

The Uluguru Mountain area in the Morogoro region is among the most productive agricultural areas in Tanzania. The area enjoys a good climate, abundant rainfall as well as fertile soils. This area which used to be the major source of food for the urban based population in most towns in Tanzania, particularly the biggest city of Dar es Salaam, is losing its importance as a reliable source of food including cash crops.

There are several reasons for the steady decline in the agricultural production in this area. One is the rapidly growing population, resulting in a greater population pressure in the area, and second is the decline in soil fertility. These two factors have caused a chain reaction in the farming process. Fewer people are finding agriculture a rewarding activity, and, therefore, more people in the area have switched to the non-agricultural activities which are thought to be more rewarding. This growth of non-agricultural activities in the area is said to have been caused by a gradual penetration of the cash economy. It has attracted most of the young population, to the extent that agriculture has been left to old people, a situation which threatens agricultural growth in the area. The biggest question at present is whether there is any possibility of reviving agriculture in this area, given the present social and economic conditions, i.e. without radically changing the present farming systems.

The purpose of this study, therefore, was to examine the current situation of farming in the study area so as to suggest improvement methods, bearing in mind the social and economic situation. As a part of a broader study on agricultural credit

and agricultural production in Tanzania, this study also aims to examine the extent to which agricultural credit policies have benefited the actual farming situation in rural areas, and how these policies can be improved. In this particular study, however, the main objective is to examine the farming problems at the village level, and seek broad alternatives to improve agricultural production. Although this study cannot be a model for the whole country, given the fact that conditions vary from place to place, it may serve as a basis for decision making in areas within the same geographical region.

THE STUDY AREA AND RESEARCH METHODOLOGY

I. The Study Area

The Uluguru Mountain area has five divisions of Bwakira Juu, Matombo, Mgeta, Mkuyuni and Tawa. Matombo Division, where the research was conducted, is about 50 km from the Morogoro town, and about 1,400 m above sea level, an altitude which gives the area a very cool climate. Two villages in this division, namely, Mtamba and Gozo, were selected for the study. Figure 1 shows the location of the study area.

II. Methodology

The farming systems approach was used. This approach aims at grasping the real

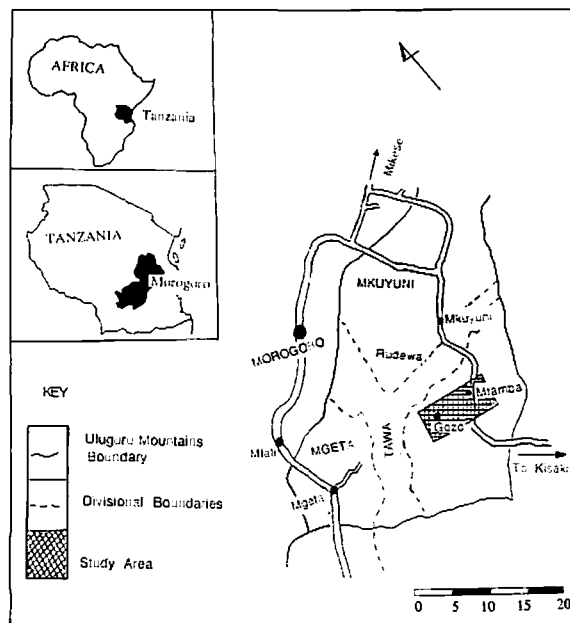


Fig. 1. Location of the study area.

situation of agriculture. A farming system, which is intimately linked with the unit of consumption, is adopted by farmers according to their know-how concerning allocation of land, labor and capital. Thus this approach is problem-oriented and is conducted locally. Most researchers of rural development now regard this method as the most appropriate methodology in analyzing the developmental problems of small-scale farming, to replace the traditional "top-down" approach, where research is conducted at research centers far away from farmers and findings sent to farmers for implementation (Ruttan & Hayami, 1973; Norman & Hays, 1979; Collinson, 1980; Ruthenberg, 1983).

Two villages, Mtamba and Gozo, were selected, based on their locations and the level of agricultural activity. Five percent of the households (N=703 and 498 respectively) in each village was randomly sampled for a questionnaire survey. The household was the sampling unit and the head of the household was the respondent. The total number of households involved in this study was 60, 35 from Mtamba and 25 from Gozo. Further investigation was conducted by informal discussions, group interviews as well as field observations. Secondary data was also collected from regional, and district agricultural offices.

The main issues studied were farming environment, farmer socio-economic background, objectives for farming and resource availability, agricultural income, farm management practices and farming problems.

FARMING ENVIRONMENT AND SOCIO-ECONOMIC SITUATION

I. Farming Environment

Small scale agricultural production in most developing countries is still highly dependent upon environmental conditions like weather, soil types, as well as the natural vegetation. It is, therefore, necessary to examine these conditions to determine the extent they affect agricultural production in the study area. The environmental factors examined in this study include temperature, rainfall, soil, natural vegetation and topographic features.

The study area has a cool climate due to its high altitude. Land is very steep and temperature varies between 18 – 20°C for the greater part of the year. The area has a bimodal rainfall distribution, with a dry spell from May through late October. The short rainy season starts around October and ends in December or early January, while the long rainy season is between March and May. The long rains determine crop productivity, and thus there is only one crop per year. The average rainfall in the area ranges between 760 mm to 1500 mm, most of it falling in storms and causing serious erosion due to the steepness of the land and lack of proper soil erosion control measures. During the off-season period, farmers spend their time doing non-farm activities.

Very little information on the soil in the study area is available, because no such comprehensive study has been conducted. Soils in the two districts remarkably vary within short distances but, in general, may be grouped as red leached soils, or Latosols.

The natural vegetation is mainly mixed Miombo woodland, but grassland with scattered trees is also common, especially in the lowland areas near Morogoro town.

II. Socio-Economic Situation

The availability of various social and economic facilities in any given area is an important indicator for the assessment of the level as well as the potential of development for that particular society. This is so because their availability contributes either directly or indirectly to the health and welfare of the individuals in that society, and also provides for the basic services which are necessary towards the development of that society. Factors examined in this study included the marital status, level of education, transportation, marketing, availability of storage facilities, water availability, medical services, agricultural advisory services and financial services.

Most farmers who were found to reside in the village were married people, probably because their family obligations have made it necessary for them to stay in the village, to take care of the family. Very few farmers had received formal education in both villages studied. Of the interviewed farmers, i.e. farmers covered by the questionnaire, only 25% and 17% from Mtamba and Gozo villages respectively, had received up to 4 years of primary education. The low level of formal education in the study area has a negative effect on dissemination of agricultural advice. However, a good number of farmers, had participated in adult education classes: 55% of the respondents from Mtamba and 59% from Gozo. There is a primary school and a primary court of justice at Mtamba, and a primary school at Gozo.

Both villages have a very poor road network. Gozo, which is more remote, is almost inaccessible by road. Mtamba has better roads since it lies on the main road to Kisaki, but the road is impassable during the rainy season.

There is a small market at Mtamba, which attracts traders from Morogoro, and sometimes as far as Dar es Salaam, but operates only once a week, on Thursdays. Both villages have a primary cooperative society, of which every villager is automatically a member. However, cooperative societies are only concerned with marketing cash crops, i.e. maize, rice and coffee. Coffee is, however, a minor crop in the study area. Farmers showed a general lack of interest in the day-to-day running of the cooperatives due to too much government interference in the activities of the cooperatives. There are no public crop storage facilities in either village but these are small storage structures owned by individual households. Only about 30% of the farmers have access to piped water, while the rest depend on water from small streams. There is a dispensary at Mtamba, but it lacks the necessary drugs. Gozo has no dispensary, and hence villagers have to seek for medical services from nearby villages.

Both villages have an agricultural extension officer, but most villagers were of the opinion that these officers are not useful. It was revealed by farmers that these officers are unable to supply them with the farming necessities like fertilizers and insecticides at the time they are needed. There is a bank branch at Mtamba, but only about 5% of interviewed farmers rely on the bank for credit. This is because most farmers feel that bank credit is too complicated and unsuitable for their credit

Table 1. Area under major crops among interviewed farmers.

Crop	Mtamba village Area(ha)	Gozo village Area(ha)	Total(ha)	% Area per crop
Maize	19.1	13.7	32.8	23.8
Cassava	19.8	13.5	33.3	24.1
Cocoyams	20.8	7.2	28.0	20.3
Oranges	14.8	12.2	27.0	19.6
Pineapples	9.0	7.8	16.8	12.2
Total	83.5	54.4	137.9	100.0

requirements.

OBJECTIVES FOR FARMING AND RESOURCE AVAILABILITY

I. Objectives for Farming

More than 90% of the interviewed farmers indicated that their primary objective for farming was to satisfy household food requirements and social obligations like school fees for children, taxes, traditional ceremonies and various rituals. Only 9.7% indicated cash earnings as their primary objective. In the study area, most land is allocated to the production of food crops like cassava and maize and relatively less land is allocated to crops produced purely for cash as shown in Table 1.

Maize and cassava are allocated more land in both villages combined due to the fact that they are the main food crop in the area. Cassava occupies about 24.1% of total land under main crops. It is followed by maize (23.8%), cocoyams (20.3%), oranges (19.6%) and lastly by pineapples (12.2%). Pineapples and oranges which are grown almost purely for cash, get the least priority in terms of land allocation, indicating the subsistence nature of the farmers.

Despite this general trend in the objectives of farming, however, proportional differences exist between the two villages studied. About 92% of interviewed farmers in Gozo indicated that their main objective for farming is food for the family, while about 88% in Mtamba indicated this as their main objective. The lower percentage of farmers indicating family food production as their main objective found in Mtamba may be attributed to the influence brought about by the growth of the Mtamba township, where the influence of the money economy is stronger.

All surveyed farmers, i.e. farmers covered by the questionnaire as well as informal discussions and observation, were found to grow at least three crops on the same plot, indicating the fact that mixed cropping is a preferred cropping system in the study area.

Cassava and cocoyam are grown as dual purpose crops, i.e. as cash crop as well as food crop. These two crops occupy about 44.4% of total land under major crops. Although these crops are not considered as tasty as maize, they are grown by almost every farmer because they act as security or famine crops. They are more resistant to unfavourable weather conditions and pests, hence providing a reliable

source of food to farmers.

It was also found that about 75% of total maize produced is consumed by the farmers themselves, 15% is sold, while 10% of the crop is lost either in the pre-harvest or the post-harvest period. For cassava and cocoyam, about 50% of these crops is consumed, while 40% is sold. The rest is lost in the field due to destruction by wild animals. Oranges and pineapples are used as cash crops with, about 70% sold and 5% consumed. After harvesting, 20% is lost due to lack of appropriate storage facilities, and 5% is lost in the field.

II. Resource Availability

The resources studied were land, labour and capital. These were all found to be very limited. Emphasis was placed on these resources because the preliminary investigations showed that these resources were the most important in the study area.

I. Land

Land is very scarce in the study area, due to the high population density and the mountainous nature of the land. Also as pointed out earlier, land is very steep and normally inherited from ancestors. Fragmentation of land is very common, with home to farm distances of about 6 km. Farmers normally leave their houses around 8 a.m. in the morning for farm work, and come back at around 6 p.m. before it becomes dark. If the farmer is assumed to walk at 4 km per hour, he will need 3 hours to walk to and from his farm, so that one-third of his working day is spent on walking. Because much time is spent on walking, the long distance makes the farmer tired even before he starts to work. Table 2 shows average distances from home to main farms for farmers in the study area.

Table 2. Average distance from home to the main farm in Mtamba and Gozo Village.

Average distance to farm (km)	Frequency	Percentage of sample
2	4	6.7
4	12	20.0
6	29	48.3
8	15	25.0
Total	60	100.0

Average distances to the main farms in the two villages differ slightly, being higher in Mtamba (about 7 km), while it is about 5 km in Gozo. The expansion of the Mtamba township makes it difficult to secure land nearby.

Various other reasons were given for such land fragmentation and long distances to main farms. Among the reasons given were the division of land among heirs, increasing population in the area which has made it necessary for villagers to look for land in distant places and also the need to look for different soil types to suit the different crops grown. For example, whereas pineapples grow well in well-drained soil, cocoyams need damp soil.

This situation, however, leads to reduction in labour effort due to tiredness as a result of long journeys to the farms. There is also less protection given to crops

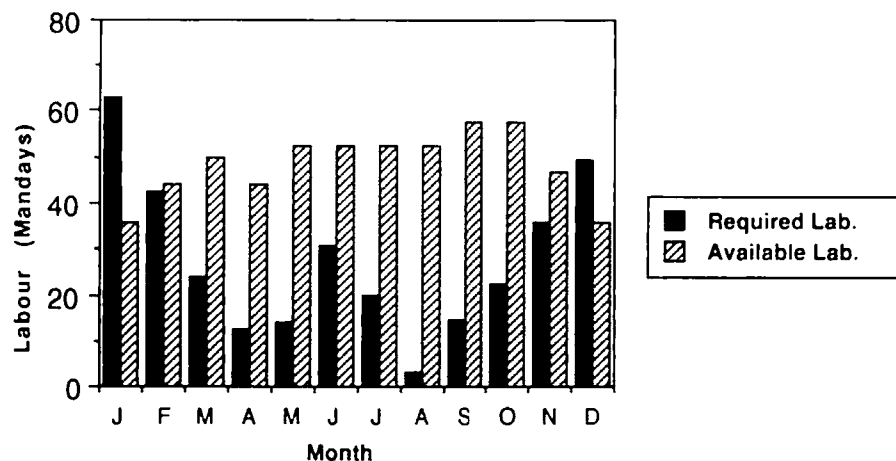


Fig. 2. Study area: Monthly labor requirement and availability.

against wild animals and birds, since farmers stay far away from farms. Also not much attention is given to the farm in applying fertilizers and insecticides. All these factors lead to poor yields.

2. Labor

Labor is one of the most important factors affecting the small farmer production process, especially when we consider the fact that small scale agricultural production in developing countries is labor intensive.

Family labor was found to be the most important source of labor in the surveyed villages. The average number of persons per household was found to be 6, with family sizes ranging from 2 to 12 people. Although the regional population distribution shows almost an equal population distribution by sex, family labor composition in the two villages studied was found to be mostly dominated by females. In Mtamba, about 75% of farm family labor was composed of female labor, while in Gozo, female labor accounted for about 50% of the farm family labor. The higher proportion of female labor found in Mtamba village is caused by the increasing number of males involved in non-agricultural activities in this village.

A monthly labor distribution study indicated that there was a shortage of labor during the peak periods for farm work, i.e. during land preparation and harvesting, in both villages. Figure 2 shows the distribution of labor in the study area. As briefly pointed out earlier, most farm work in the study area is done by old people and females, as the majority of young people, especially males, either have migrated to towns, or are engaged in non-agricultural activities in the village which are said to be more profitable. Such activities include tailoring, carpentry, shoe-making, etc. The influence of these activities is particularly high at Mtamba which is growing into a township.

Rarely do farmers use hired labor because of two reasons. One is based on the fact that during the peak periods, every farmer is so busy in his farm that nobody is

willing to be hired. Secondly, farmers generally lack the capital necessary to pay for hired labor. This situation leads to prolonged farm work, in most cases not completed by the onset of first rains around October, a factor which leads to a poor crop yield. This kind of labor regime calls for the introduction of improved technology in the area, particularly for land preparation and harvesting, to speed up the completion of these activities. The introduction of draught animals to be used in ploughing and transportation may be one possibility, but improved crop mixtures to economize labor, simple harvesting and milling machines may also significantly contribute toward improved crop yields.

It must, however, be noted that there is excess labor during most of the year. This kind of seasonal unemployment is common in the rural areas, due to the fact that there is only one crop per year, and also the fact that farmers lack enough income-generating activities to keep themselves busy during the off-season periods. In the study area, during such periods, some farmers are involved in non-agricultural activities like trading, but their number is limited. Research on innovations which make use of idle labor during off-season periods should also be encouraged.

3. Capital

Farm households in the study area were found to be using simple tools for farm work. The common tools include the hand hoe which is used for ploughing, bush knives, axes and other simple tools for bush clearing. All these tools are low technology tools which are hand made and give very low return to labor. No farmer was found to have used a tractor or an ox-plough in farm work. Improved seeds are also hardly used.

Money capital is very rarely used in the study area, given the fact that most farmers are fundamentally and still subsistence-oriented, depending on family labor to perform farm work. However, as already pointed out, the need for cash income is growing, since farmers need to raise some money to pay for various services like child education and taxes. Recently in Tanzania, the re-introduction of the development tax, which was abolished following the Arusha Declaration, has necessitated most rural dwellers to seek means to raise cash income, particularly by growing some cash crop. Cassava is one of such crop, but it is used as both a source of income as well as daily food. Other crops used as sources of income are cocoyams, oranges and pineapples. Table 3 shows the major sources of cash in terms of gross values (total incomes) for major crops. Gross values are calculated

Table 3. Area by main crops and total gross value for major crops in the study area.

Source (Crop)	Area (ha)	Gross Value (TShs.)	Proportion of Total Gross Value
Maize	32.8	3,628	12.2
Cassava	33.3	9,291	31.3
Cocoyams	28.0	5,044	17.0
Oranges	27.0	6,102	20.6
Pineapples	16.8	5,599	18.9
Total	137.9	29,664	100.0

on the basis of farm-gate prices, i.e., local farm level prices.

It should be noted that maize contributes only about 12.2% to the total gross value, but is second in land allocation, indicating that the farmer's primary objective is still subsistence production, despite the fact that he needs some cash income. Cassava, which contributes 31.3% to the total income, comes first in terms of land allocation because it is a dual purpose crop. Oranges and pineapples which are treated as cash crops are allocated least land and thus contribute less to the total income, if compared with cassava.

FARM MANAGEMENT PRACTICES

Given the objectives of farming and the availability of farm resources as already discussed, farmers in the study area have developed various methods of organizing their production process, so as to satisfy their objectives, given the available resources. Various cropping systems and husbandry practices were observed in the study area.

I. Cropping Systems

Most farmers in the study area were found to practice mixed cropping. Under this system, more than two crops are grown on the same plot of land, without any systematic arrangement in rows. However, various mixing ratios are used, depending on the choice of the farmer. Intercropping was also found in the study area, but when found, it was common that the mixture included a woody crop, for example, when cassava, maize and legumes were grown on the same plot.

Maize, the main staple in the area, was found to be grown in both pure stands as well as being mixed with other crops. The crop is normally mixed with many crops, including cassava, beans, paddy and also with tree crops like oranges.

Cassava is also sometimes found in pure stands, or mixed with sweet potatoes, bananas and cocoyams. Such mixed cropping is preferred by the farmers because it is labor saving. The large canopy provided by cocoyams inhibits weed growth, such that weeding is done only once, during the early stages of establishment. Planting and harvesting is also done together. The biggest problem associated with cassava in the study area was found to be a virus disease called cassava mosaic. There were no appropriate disease control measures found in the study area. Oranges are normally planted with bananas, paddy, as well as maize. However, the crop is often attacked by aphids. Pineapples are normally grown in pure stands, especially on steep land.

Several reasons were given by farmers for their preference of mixed cropping. Most farmers indicated that intercropping, as well as mixed cropping were necessary practices because they result in a more efficient land utilization, especially given the critical shortage of land in this area.

The need to control run-off water caused by heavy rainfalls is also another reason for intercropping. As already discussed earlier, most rainfalls in the study area come in storms, causing serious soil erosion. When various crops are grown

Table 4. Average yield per area in the study area compared with standard yields in East Africa.

Crop	Average Yield (kg/ha)	Standard Yield (kg/ha)*
Maize	945	4,400
Cassava	5,340	8,750
Cocoyams	5,610	12,500
Oranges	4,000	13,000
Pineapples	3,500	25,000

* : For standard yields (Acland, 1977).

together on the same plot of land, the crops cover more land, hence protecting the soil from run-off water.

Farmers also indicated that when crops are mixed together, less labor is required to perform the various activities, and also individual crop yields per land area become relatively higher than in monocropping.

These views have been supported by various researchers, including Norman (1974), who conducted a similar study in Nigeria and found that the more the crops were mixed together on the same plot of land, the less the additional work needed for each additional crop. Also Innis (1980) suggested that it was more advisable to grow two or more crops on one plot because it made better utilization of nutrients.

Normally fire is used for land clearing in the area, and farmers said that this was preferred because it reduces labor, at the same time improving soil fertility. Other practices like crop rotation were not observed in the study area. Farmers said that it was not possible to undertake crop rotation because land was inadequate for such a practice. This being the case, crops have to be grown on the same plot of land year after year, a factor which has led to the gradual decline in soil fertility.

There is also generally poor crop management throughout the crop season compared with intensive farming systems in the Kilimanjaro region, as will be explained later. No fertilizers or insecticides are used. These poor management practices have led to very low crop yields in the area as shown in Table 4. It should be noted that yields for all crops are well below 50% of standard yields, i.e. yields for crops grown under optimum conditions in the East African region, except for cassava, for which yield is about 61%.

II. Farming Problems

Most interviewed farmers indicated that land scarcity and lack of labor were the main problems in farming. About 55% of the respondents cited these problems as crucial problems in farming. Other problems described by surveyed farmers were the unreliable rainfall and the declining soil fertility.

Although these were the main problems cited by the farmers, this study has shown that the farming problems in the study area are much more than what the farmers describe here. The failure on the side of the farmers to recognize the magnitude of farming problems in the area may apparently explain the slow pace at which agricultural change in the study area is taking place. The main problems in the study area, identified by this study, may be summarized as listed below:

(1) Very low crop yields and high crop losses, both before and after harvesting, especially crop losses owing to lack of crop storage facilities.

- (2) Remarkable decline in soil fertility due to lack of appropriate soil fertility conservation and erosion control measures.
- (3) Low level of education, which may result in low capability to adopt new agricultural innovations.
- (4) Uncertainties about weather, particularly rainfall.
- (5) Poor marketing infrastructure, especially for the marketing of perishable food crops.
- (6) Lack of transport facilities and poor road network.
- (7) Poor farming implements.
- (8) High population density resulting in difficulties in securing farm land.
- (9) Land fragmentation and considerable loss of time in walking from homesteads to farms.
- (10) Aging agricultural labor and migration of the young population to urban areas to seek paid jobs.
- (11) Farmers' increasing involvement in non-agricultural activities which may result in sidelining agriculture as a secondary activity.
- (12) Persistence of subsistence production objectives.
- (13) Lack of credit facilities to enable farmers adopt innovations requiring high initial capital outlays.

CONCLUSION

This study has shown that small holder farming in the study area is now based on permanent farming, although the farming techniques originate from shifting cultivation, which has slowly changed into this form of farming. Farmers market a certain proportion of their crops, but their farming is still based on subsistence objectives.

The survey also showed that yields are very low, a situation which may have been caused by the low level of technology, lack of improved seeds, fertilizers, insecticides, etc. The only way used to improve soil fertility was bush burning, which may not be sufficient.

From these observations, it can be said that the current farming systems in the study area are based on traditional farming, which was designed to satisfy the subsistence objective of the farmer, at a time when the economic situation as well as resource constraints in the area were different from now. With population increasing fast, soil fertility deteriorating, and money economy penetrating rural areas, farmers have been too slow in improving their farming. The farm production system now fails to satisfy farmer needs, a factor which has led to an increase in family members' moving to the urban areas for paid jobs or involvement in off-farm activities, so as to increase household incomes. This situation threatens agricultural production in the area.

According to my observations, under the situation which prevails in the Uluguru Mountain area, there is still a potential to increase agricultural production. The situation in this area is very similar to the prevalent situation in the Kilimanjaro region, both in terms of resources as well as the farming system. However, farmers

in the Kilimanjaro region have changed their farming more positively to counter the problems in the area, resulting in an increased agricultural production. In the Kilimanjaro area, to counter the problem of land scarcity and declining soil fertility, intensive use of green and animal manure to improve soil fertility is practiced. This effort has enabled farmers realize high yields from a plot cultivated continuously. Farmers in the Kilimanjaro region also incorporate livestock in their farming mainly for the provision of animal manure to be used on farm. Given such a densely populated area, also faced with the problem of land scarcity, this has been only possible by adopting a zero-grazing type of livestock production. Under this system, livestock is confined and fed in stalls. No livestock grazing is practiced. Soil conservation in Kilimanjaro is well practiced by terracing as well as mulching, which are practices worth undertaking for the farmers in the Uluguru Mountain area. The current practice of controlling run-off water by mixed cropping in the Uluguru Mountain area is a viable practice, but it will be more effective if reinforced with the method suggested above.

Other improvements, however, may require government assistance and mobilization of farmers. Such improvements include the provision of a reliable infrastructure to facilitate crop transportation, marketing and storage as well as farmer education. It is also necessary to introduce appropriate crop disease control measures in the study area, coupled with improved technology like hand or animal drawn implements, simple milling machines, etc., to speed up farm operations.

There is also the need to encourage farmers to improve their objectives of farming from simply subsistence level of production, to a higher level of production that produces a surplus for the market. If such an objective is attained, it will also be easier for the government to provide the necessary agricultural credit and enforce its recovery.

It is the intention of the researcher to resume this study in future, so as to provide more concrete suggestions as to which agricultural production in the study area may be improved and on actual technological changes required. Such a future study will preferably involve not only comparative studies, but also farm experimentation, broadened to cover a wider range of aspects, including agronomic, as well as socio-economic factors, particularly, the role of credit, without which it will be difficult to improve agricultural production in the study area.

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